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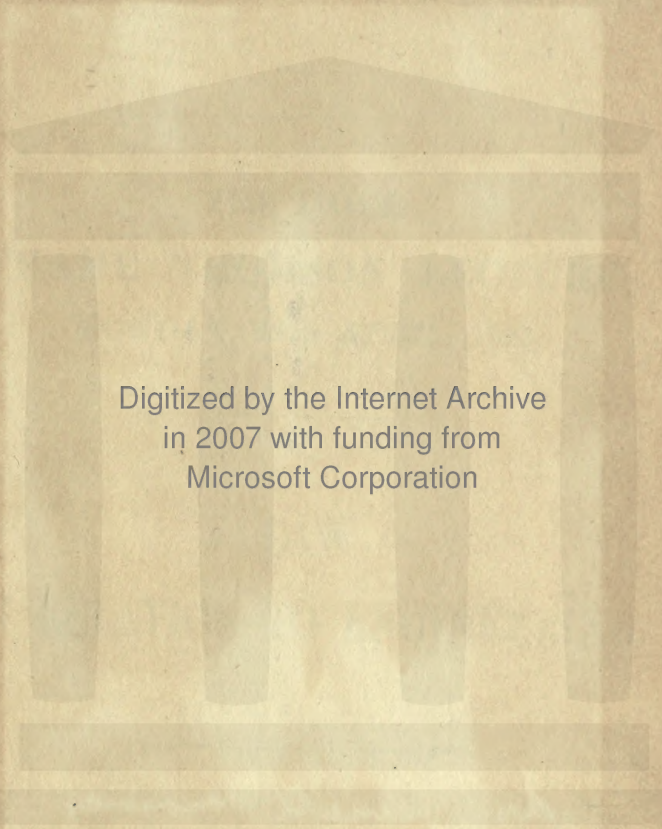
LAW
IN RELATION TO ENGINEERING.

FRAME THOMPSON LECTURE : 1913.

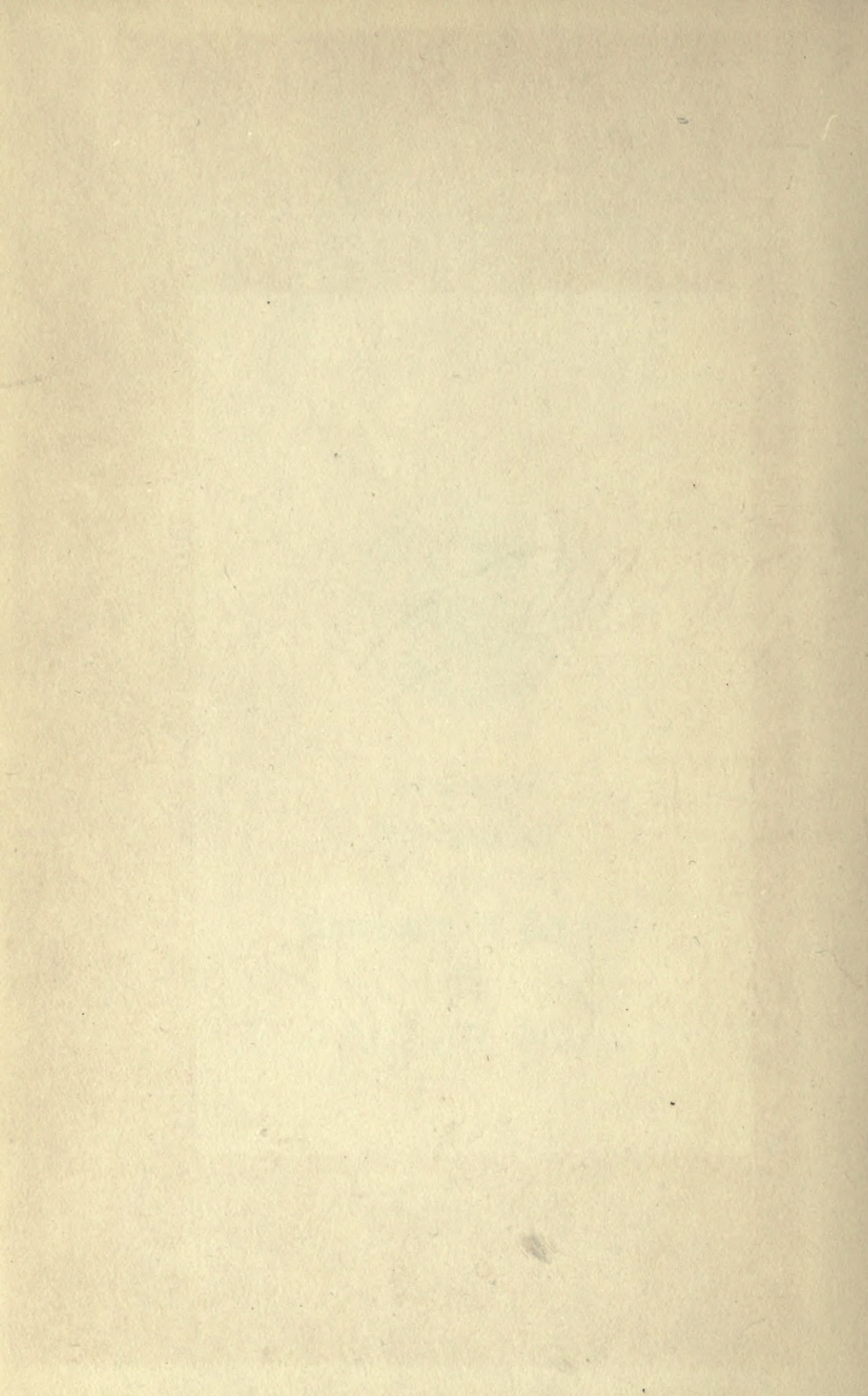


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THE INSTITUTION OF CIVIL ENGINEERS.

THE THIRD
FRAME THOMSON LECTURE:
MONDAY, 28TH APRIL, 1913.

LAW
IN RELATION TO ENGINEERING.

B. HALL BLYTH, Esq., M.A., Vice-Pres. Inst.C.E.,
IN THE CHAIR.

144/193.
29/10/17.



Notice.

In the ordinary course the reports of these lectures are sent only to the students of the Institution. Some students who are approaching the limit of age for studentship have expressed the wish to receive the reports of future lectures. Those who desire to follow up the subject in this way should send their names and addresses to the Secretary of the Institution.

Mr. A. A. HUDSON, K.C., has kindly consented to deliver the 1914 lecture taking "Engineering Contracts" as his subject.

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MONDAY, 28TH APRIL, 1913.

LAW IN RELATION TO ENGINEERING.

B. HALL BLYTH, Esq., M.A., Vice-Pres. Inst.C.E., IN THE
CHAIR.

Supported by

EDMUND BRISTOL, Esq., K.C., M.P. (Dominion of Canada).

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W. S. POOLE, Esq., Managing Director of the Industrial and
General Trust.

DAVID SIMSON, Esq., M.Inst.C.E., Chairman of the Buenos
Ayres Great Southern Railway Company.

J. MURRAY TULLOCH, Esq., Director of the Primitiva Gas Com-
pany,

and other gentlemen.

The Chairman:—

In introducing the lecturer, Mr. Frame Thomson, said that Mr. Thomson did not require any introduction to the London students of the Institution of Civil Engineers, seeing that he had founded the Frame Thomson Lectureship, and had already delivered two most excellent lectures. On the present occasion the lecturer proposed to deal with a more difficult subject than either of the two with which he had already dealt, namely, law and engineering combined, the one being a necessary corollary of the other. He would not take up more time by forestalling anything that the lecturer had to say, but would at once ask him to deliver his lecture.

Mr. Frame Thomson :—

In the first lecture of this series, when touching upon the various kinds of commercial knowledge desirable for engineers, I made reference to a knowledge of law as being one of these. I wish at the outset of the present lecture to emphasise the warning I then expressed against the idea that such legal knowledge should be regarded as in any way rendering the engineer independent of legal advice. On the contrary, as I pointed out, it will serve the useful purpose of giving him some impression of the difficulties and dangers that may result from acting independently of such advice, and should enable him to appreciate more fully its value in the complicated circumstances of modern life and work.

I do not intend this evening to presume upon the province of the professional lawyer by attempting to give you instruction in any branch of the subject. In so far as I may have occasion to refer to legal principles or rules it will be merely by way of illustrating the nature of the contact with them which may arise out of your work as engineers. It is the intention that subsequent lectures of the series shall include the treatment by expert lawyers of the subjects about which it is important that you should know something in detail.

The study of law is not necessarily of the dry-as-dust character it is often represented to be. Like all other products of civilisation it is the outcome of an evolution, the history of which possesses a high intellectual interest. From the early customs established by mutual consent of the members of small communities to the elaborate codes of some modern nations and the still more intricate and elaborate case and statute law of England this transition has been slow, gradual, and over moderate periods of time almost imperceptible, although marked at various stages by changes of such importance as to entitle them to be regarded as distinct steps. I shall not take up your time with any prolonged essay on the origin and development of English law, but a few words upon certain features of it may help to justify the claim that you must add some legal knowledge to your equipment if you are to be considered complete in your qualifications for your work. It is a fundamental principle of English court practice that every man is presumed to know the law, and, like many another legal fiction, although quite impossible of realisation, is not infrequently impressed upon plaintiff or defendant as a cold hard fact of daily life. You may quite conceivably find yourselves some day upon the horns of this impracticable dilemma, and it behoves you to acquire such knowledge as may reduce that possibility to a reasonable working risk.

In order to start at zero, picture to yourselves one man upon an otherwise uninhabited island. Obviously no laws are required for the regulation of his existence. He is free to exercise or control his instincts according to no rule other than his own inclinations. If, however, another man lands upon the same island possibilities arise of clashing or overlapping interests, and if both are equally matched in every respect so that there is no imposition of the will of one upon the other without his consent, customs will develop for mutual convenience by which the freedom of each will be voluntarily limited. Should, however, one of them be more than a match for the other he will impose his will so that the freedom of the latter will be restricted in some respects for the convenience of the former only. The customs so established and maintained by the authority of the former become laws for the latter. This will give you some idea of the distinction between conventions (customs or rules of conduct recognised by mutual consent) and laws (customs or rules enforced by authority). Proceeding a step further and assuming the community to have grown to such respectable dimensions that no one member of it is capable of imposing his will upon the rest, we find that its life will be regulated by customs recognised as beneficial to the society and enforced by the members of the group as a whole upon the individuals composing it. Up to this point the customs regulating the social life will be of such simple character as to be readily understood and concurred in by each individual and will as a general rule be based upon principles inherent in human intelligence, being in reality a sort of code of common sense. The principle that every man is presumed to know the law has a practical meaning in such a community, as each member has a personal part in the making of it and the range of action touched by such primitive law does not wander very far from the daily life of each member of the community. With the continued growth of the society the life of individuals tends to become less and less identical, new occupations are developed, family and property rights give rise to greater detail in the customs regulating the communal life, and generally speaking the scope of the law extends beyond the incidents of daily life common to each individual. Adaptation of old customs to new circumstances requires a greater degree of personal attention and time than can be given by the members of the community as a body. Selected members become charged with the duty of settling disputes and in the course of their proceedings give interpretations of old customs which become new law, accepted as such by the rest of the community. This process of lawmaking by adaptation of existing rules, effected by interpreters of the law or

judges, soon however reaches a point where the results become clumsy and artificial, owing to the extreme divergence of the new circumstances from those under which the original rules came into existence. The final stage of lawmaking is then reached when the sovereign power, be it King or Council or Parliament, dictates rules of its own initiative and enforces them by its own authority. To the ordinary layman the expression "law" generally connotes the idea of an Act of Parliament, in spite of the fact that probably at least one half, if not more, of the law regulating his daily life is innocent of Parliamentary sanction and only to be found recorded in decisions of courts going back over many centuries referred to as "the common law." Some of the more important phases of the common law, more especially those principles which have been found most difficult of adaptation to the rapid evolution of modern commercial and industrial development, have been superseded and replaced by statute laws. Instances also occur in which the same question may be tried either under the old common law or under a statute dealing with the subject without superseding the former so that they run side by side, as it were, and you or your adversary have choice of horses.

It is interesting to note here that the essential feature of "law" is that it must have behind it a recognised authority with power of enforcement. The so-called international laws of which we hear so much loose talk nowadays are mere conventions which several Powers have from time to time admitted to be desirable guides for international conduct, but having no binding effect upon any one of such Powers that may choose to disregard them, and is strong enough to ignore the protest of the other Powers.

The scope of the laws to which the engineer is subservient ranges from his personal rights and responsibilities towards his employers and third parties, over a wide area to culminate in the most elaborate statutes laying down regulations governing public service corporations, such as railways, water and electric supply. A rough analysis of his relationship with the law may be made up as follows in approximately the chronological order of the steps by which his work proceeds :

Work.	Vis à vis.	Legal Aspect.
1. Preparation of designs, specifications and estimates for submission to public bodies.	Employer.	Failure to exercise skill proper to his position in the profession involves liability for damages arising from such failure. Laws governing relations between principal and agent.

Work.	Vis à vis.	Legal Aspect.
2. Technical assistance in obtaining necessary powers from public authority to execute works.	Employer.	Failure to exercise skill as above mentioned or to ensure the compliance with public or special Acts of Parliament or regulations of proper authorities involves liability for damage as above. Laws governing relations between principal and agent.
3. Preparation of working plans, specifications and estimates from which the works can be constructed.	Employer and third parties engaged in executing the works or providing component parts.	Same as 1.
4. (a) Execution of works by administration; or (b) Supervision of their execution by third parties.	Same as 3 and public generally	Same as 1; also involves compliance with the law of contracts, law of master and servant, laws of property and trespass, laws affecting damage to life and limb, laws affecting personal rights, <i>e.g.</i> , the Truck Act, and others such as special acts and regulations governing the construction of certain classes of public works.
5. Final settlement of payments for work done and questions arisen in course of execution.	Same as 3.	Same as 4, plus Arbitration Acts and laws of evidence.
6. In special capacities in connection with the operation of works after execution.	Employer, third parties and public generally.	Generally as 4, plus laws affecting transportation, warranty of quality of goods, bills of exchange, buyer and seller, and special acts and regulations relating to public services such as railways, tramways, water, electric supply, etc.

This is not intended to be an exhaustive presentation of an engineer's points of contact with the law, but merely an illustration of some of the many points arising in the course of a programme of work which in general terms is a very common one. Even in this sketch the points of contact are so many and varied that it would be obviously impossible for the engineer to qualify himself for dealing with them without such a course of legal training as would interfere with proper technical education for his own profession.

Nevertheless, he cannot afford to treat them lightly. If he acted in such matters on his own initiative he would probably be presumed to have represented himself as qualified so to do, and be liable in event of trouble, for damages resulting from his action. Even with the advice of a lawyer, if wrong, he is not

relieved from all responsibility. It is, therefore, of importance that he should have some intelligent idea of where danger lies, so that he may put himself within the principle that he is supposed to know the law, by obtaining suitable legal advice.

Probably the most important of the laws touched upon in the above outline is that of contracts, and a short reference to some of its features will perhaps illustrate as well as anything can the nature of the knowledge an engineer should himself possess. It is interesting also as showing the distinction between the principles of law and the machinery of law devised for proving compliance with the principles.

A contract is an agreement between two or more parties under which each is bound to do, or refrain from doing, something in consideration of a complementary act or restriction on the part of the other or others. If I merely agree with you that I shall be at St. Paul's at nine o'clock to-morrow morning there is no contract, and if I fail to be there at that time you have no legal basis of claim against me. But if we agree to meet at St. Paul's at that time for a legitimate purpose and one of us negligently failing to be there the other suffers material loss, he will have ground for compensation. The essential facts constituting a contract are therefore:—

- (1) An obligation to be undertaken by A. to B.
- (2) An obligation to be undertaken by B. to A.
- (3) Agreement between A. and B. as to the precise terms of (1) and (2).

The contract comes into existence, and is binding on A. and B. at and from the moment when (1), (2) and (3) are clearly present in the same terms in the minds of both. A large proportion of the elaborate rules constituting the Law of Contracts consists of machinery devised for the purpose of proving the existence of this unanimity and the moment of its occurrence.

For many purposes a merely verbal understanding, if admitted by both parties, or in event of dispute if supported by satisfactory evidence, forms a sufficient contract, and this covers most of the contracts entered into consciously or unconsciously in the minor routine of daily life. But in business generally the consideration on one or both sides is of a complex character, and liable to *bona fide* misconception by either party, so special care is essential if disputes are to be avoided. The subject matter of the contract is usually of such importance that misunderstandings might involve considerable risks to one party or both. The law, therefore, lays down certain rules which must be com-

plied with before the contract will be enforced by the Courts. For example, an agreement that is not to be carried to completion within a year must be embodied in a written document or documents, which may consist of a series of letters. The most effective form of contract is by deed executed by both parties, so that each adopts as his understanding of the agreement a specific wording from which, presumably, all ambiguity has been eliminated by discussion. Further impressiveness is added to the document by the operations of sealing and delivering, both of which are required by law. In many transactions of frequent occurrence special forms of words have been adopted as standards, as, for example, transfer deeds for the purchase or sale of the shares and other securities of limited and chartered companies. Whatever the form or sanctity of a contract may be the essential conditions of validity are mutual considerations and unanimity. However carefully the document embodying the contract may have been prepared, if these essential factors are not present, by reason of mistake or fraud, the contract may prove not to be enforceable. In the case of mistake, however, the mistake must have been made by one party within the knowledge of the other.

As regards the moment of time at which unanimity is reached there can be no doubt in the case of a deed, as its execution by both parties settles the question; but in the case of contracts made by offer and acceptance contained in letters of different date, difficulties may arise, and the law provides that the offer is made at the moment the letter containing it is deposited within the control of the postal authorities. If the party making the offer desires to withdraw it by a subsequent letter, it remains open until such a time after the posting of the letter of withdrawal, as would in the ordinary course of post enable that letter to reach the addressee, and should the latter have written and posted an acceptance prior to the lapse of that time a binding contract will have been established. It is important to bear in mind that an acceptance must be of the precise offer that has been made. If conditions are inserted in the acceptance these must in turn be agreed to by the original offerer before a contract is complete.

An important rule to be kept in view in daily business such as an engineer carries on, is that a contract made in a given form can only be modified by subsequent agreement in the same form or in a form more elaborate. For example, a contract embodied in a deed cannot be modified by mere exchange of letters unless the deed itself provides for modifications in that way as part of the original agreement. Nor can contracts embodied by letter be

modified verbally. These statements, although true in general, are not universally so, as the law admits certain acts as evidence of agreement between the parties. For example, the acceptance of a portion of a batch of goods as proving intention to accept the whole. There are many features of this side issue of the subject which it is important that an engineer should be familiar with, as they relate to matters of daily occurrence upon which he has to take immediate decision, and about which he cannot be running back and forward to a lawyer on every occasion. They may very well form the subject of a later lecture.

The interpretation of legal phraseology has a practical interest for the engineer, as many words have by repeated use in the same connection acquired special meanings in legal use. The engineer who is engaged in carrying out a contract embodied in an elaborate deed should go over it carefully with his lawyer, and make sure that the meaning he attaches to its phrases is that which will be admitted by a Court of law, otherwise he may find himself in perfect good faith committing breaches of contract. The same difficulty may arise from the opposite side, as words which by force of habit and technical convenience have acquired a restricted meaning to the mind of the engineer may be used by the lawyer who draws the deed in a way that conveys more than was intended by the engineer who instructed him. Normal load, rated capacity, etc., mean different things in different connections, and I have seen cases where such expressions have been used in the same deed with several meanings, so that only by an elaborate process of inference was it possible to select one as the material basis of the contract. My experience has been that lawyers are not only extremely painstaking in the endeavour to avoid such ambiguity, but helpful to a degree in assisting the engineer to give clear and complete expression to what he means, if he only understands it himself, and has the intelligence to convey his meaning to them, however crudely. This matter of the clear drafting of contracts is one of the most important of the instances in which the engineer by some familiarity with legal habits of thought and forms of expression can be of great practical value to his associates.

I would again refer you to the first lecture of this series, in which I endeavoured to emphasise the principle that unless the engineer has some familiarity with the principles and practice of the professions with which his work brings him into intimate contact, he cannot pull his full share of the load nor contribute as he should to the attainment of the highest efficiency in the final result of the combined effort.

I have felt the greatest admiration for the receptivity of mind exhibited by lawyers and accountants in appreciating the engineer's point of view in business requiring common effort, but I confess that the instances of reciprocal intelligence on the part of engineers have been—in my experience—lamentably rare. The desire to stimulate an improvement in this respect was one of the strongest motives leading up to the establishment of these lectures.

There are many other principles of law important to engineers which I could touch upon—such as the relations of principal and agent—but we all desire the privilege of hearing a few words from some of the distinguished lawyers who are here to-night, so I shall now withdraw myself into the congenial background with the hope that, meagre and superficial as my remarks have been, they may have moved your minds one step further towards taking a practical interest in non-technical business related to your own work.

The Chairman

Said it was his privilege to ask the members to accord a very hearty vote of thanks to Mr. Frame Thomson for his lecture. He was sure all present would agree with him that the lecturer had dealt with a subject which was deeply interesting, not only to students, but to every practising engineer. Personally, he knew of nothing which it was more essential for an engineer to know than a very considerable amount of law. If a student wished to attain to any great height in the profession he must know nearly as much law as he did engineering. As the lecturer had stated, one of the first things a young engineer was often called upon to do was to draw a Specification, and it must be done in such definite and decisive language that as little doubt as possible could be thrown upon what its meaning was if it ever unfortunately came before the Law Courts. He hoped the students would not mistake him when he said that they would have to draw up Specifications themselves. They must not run away with the idea that they could do such work without the assistance of a lawyer, because it was by means of the combined brain of the lawyer, who knew the technical language, and the engineer who told the lawyer exactly what he wanted to express that a proper Specification could be drawn. Legal matter came into every single walk of an engineer's life. Supposing, for instance, an engineer was told to construct a railway which had been authorised by Parliament, there were no end of provisions in the Act of Parliament authorising the railway which required

to be attended to by the constructing engineer. He must have a certain amount of legal knowledge, and he must be able to interpret the Act of Parliament to give effect to the various clauses in that Act for which the engineer was responsible. If a Bill was promoted in Parliament it would no doubt be opposed by a great many people, and the engineer would possibly have to meet many of his opponents before the Bill went into Committee, and adjust clauses with them. Those clauses would probably be drawn by a lawyer, but they had to be revised and verified by the engineer, and in order to do that properly the engineer must possess a very considerable amount of legal knowledge. Then if the students were ever going to be great men in their profession, one thing above all others that they would have to do was to give evidence. All engineers had to look forward to the day when they would first go into the witness box—a very nervous proceeding—but it was essential if the students wished to take a position in the engineering world that they should be fit to give evidence when called upon to do so. Speaking with a very considerable number of years experience of giving evidence, he thought the evidence engineers had to give might be classified under three heads. First of all there was evidence purely and strictly of the legal class, evidence given before the Law Courts, where the witness was bound to answer absolutely the questions put by counsel, and where evidence was, as far as possible, simply evidence of fact. The second kind of evidence which engineers might be called upon to give was in arbitration cases, which was entirely different from giving evidence before the Law Courts. There was a mixture of the Law Courts and a mixture of what he was going to deal with under the third heading in the evidence in arbitration cases. But where the engineer was called upon to exercise ingenuity to a greater extent than in any other capacity was when he was called upon to give evidence before Parliamentary Committees. There, if he might say so in the presence of so many distinguished lawyers, the engineer had more or less of a free hand. It was the duty of the engineer to make the case for the Bill that he was promoting, or to make the case for the opposition which he was supporting. When counsel made their speeches in introducing Bills, or introducing opposing Petitions, they always told the Committee that the question would be more fully explained by the witnesses they were going to call, and therefore, as he had already said, in Parliamentary Committees the witness had an absolutely free hand. He could neglect altogether all principles of evidence, and tell the Committee, in the most pleasant manner he could possibly assume, everything

that he thought was important for the advancement of the side of the case which he was advocating. If he might give a word of advice to the students of the Institution it was never to be afraid of counsel. If the engineer knew anything at all about his case, he knew, or he ought to know, a great deal more about it than the counsel on either side, so far as the engineering side of the question was concerned. Counsel only knew what was put into his head by the engineer, and, therefore, if an engineer had thoroughly studied his case, he could absolutely floor counsel if he attempted to cross-examine him too hardly. Another word of advice he gave to students was that they should never try and fence with counsel. They should be absolutely frank, free and straightforward, and tell counsel everything they knew and that they believed to be the truth. He had seen many engineers and other witnesses distinguished in various walks of life absolutely fail because they thought they could fence with counsel and beat him. That was the very thing where counsel got the better of the witness. As long as the witness dealt with his case freely and in a straightforward manner he had the better of counsel, but if he attempted to fence with counsel and beat him in that line, the students might take it from him that the witness would come off second best. Another subject with which engineers had a great deal to do, and in which a considerable knowledge of law was absolutely essential, was in the conduct of arbitrations. Engineers had, from the very nature of things, to sit as arbiters over and over again in important cases. In order to do that properly they must know a considerable amount of the laws of evidence, and they must be able to apply a legal mind to the evidence that was given before they could come to a proper decision. The lecturer had alluded to engineers having been brought before the House of Lords on one or two occasions. In the celebrated case, which was quoted in all the Law Courts, of *Boyd and Forrest v. The Glasgow and South Western Railway Company*, the Engineer of the latter Company was taken to the House of Lords on the charge of fraud, the fraud that he was accused of being the falsification of various borings. He did not wish to go into the details of the case, but the House of Lords eventually exonerated Mr. Melville, the engineer in question. A good many years ago he was before the House of Lords himself on a ground of fraud of a different kind. He was engaged as arbiter in a very big arbitration where he decided against the contractors, holding that they were liable in penalties to the Company. The ground of fraud on which he was taken to the House of Lords was that he happened to be the Consulting

Engineer to the Railway Company which had made the contract with the contractor. In that case he was exonerated as Mr. Melville was, and he stood before the meeting that evening as a clean engineer. He did not intend when he began his remarks to take up so much time, but the lecturer had dealt with what he looked upon as one of the most interesting subjects that engineers had to deal with. He therefore had very great pleasure in proposing a cordial vote of thanks to him for his lecture, and in asking the President of the Students' Committee to second the motion.

Mr. P. G. Bowie (*Chairman of the London Students Committee*)

Assured the lecturer, on behalf of the students present, how much they appreciated his action, not only in founding the Lectureship, but in giving so much of his personal attention and time to its development on such useful lines. As the students were very anxious to hear what the other speakers had to say, he would content himself with formally seconding the vote of thanks which had been moved by the Chairman.

The resolution was then put and carried unanimously.

Mr. A. A. Hudson, K.C.

Said that he desired to tell the students something about engineering contracts. A young engineer's first desire was to have some work to carry out, and for that purpose he had to get a tender from a contractor. Questions of law with reference to the offers or tenders for the work might then arise. People very often wondered whether the contractor was bound by the tender which he had given. The answer was that he was not bound in any way. He might be bound in honour, but he was not bound by law; it was a mere offer which could be withdrawn. In order to bind the contractor, it was necessary to have some consideration for the continuation of the offer, *i.e.*, if the engineer said to him, or put in writing, that in consideration of the contractor continuing the offer for so many days the employer would pay him so much money, that would be a perfectly good contract and the contractor could not withdraw it. The same thing arose very often when an offer was received to take a house. The mere offer to let or sell a house was not binding, but if the person offering it agreed that, in consideration of the sum of sixpence now paid, he would allow the offer to remain over for so many days, that was a perfectly good contract.

He wished to support everything the Chairman had said with regard to the question of the drawing of Specifications. One of the first things an engineer had to do in every contract was to draw a Specification, and a great proportion of the disputes which afterwards arose occurred owing to inaccuracy of expression. He advised the students to spend endless time in putting into the clearest form what they desired carried out, whether it be engineering, or building, or what not. He had the pleasure very often to come into contact with some of the best engineers of the day, and the trouble they took in drawing up even one clause would scarcely be believed. Sometimes the drawing up of one clause, perhaps a comparatively unimportant one, took two or three hours, but it was the essence of an engineer's profession that he should be thorough.

The next essential to an engineer was that he should have foresight, because it was necessary for him to anticipate the various matters and conditions which were likely to happen. The other parts of the contract which the engineer would necessarily have to settle, or to assist in settling, were the conditions on which the work was to be carried out. He strongly advised the students never to mix, if they could help it, a Specification with Conditions, or if they did mix them and had to obtain advice from a lawyer, they should let the lawyer see the Specification that had been drawn, because if that were not done the result might be that the Specification would have one set of conditions, the contract would have another set, and that would be a most fruitful source of litigation. Conditions required the very greatest care just as Specifications did. He further advised them not to slavishly copy what had been handed down to them by their grandfathers or even their fathers, because everyone, he was sure, would agree with him that what was a good Specification thirty years ago was not good at the present time. Perhaps he might relieve the monotony of talking about law by telling the students of one of his experiences with regard to Specifications copied from ancient history. A very well known architect specified timber for a particular building of a brand which had ceased to exist for thirty or forty years. The architect was not a reasonable person, and he required the contractor to carry out his contract. The contractor said, "I cannot do it; there is no such timber in the market." The architect replied, "You have contracted to do it and you must do it." As a result the work was taken out of the contractor's hands, because he could not do what was impossible.

The contractor waited until the architect and his employers tried to get the material, which he knew was impossible to obtain. They failed to get the material and used something else. The contractor then said to the architect, " Now you are breaking your contract ; you have interfered with my work by introducing a totally different material from what was specified."

He advised the students to draw Conditions in the same way as they would a Specification, and particularly to get them under heads. He emphasised that the Clauses should not be confused and mixed up anyhow, but should be classified so that any one could understand what was intended, and know where to find the different provisions. For instance, it was advisable to start with the heading of " Definitions "; then question of discrepancies in drawings should be dealt with as a separate heading. The approval and the passing of materials, tests and similar matters would come under the head of " Approval." Sub-letting should be dealt with by itself. " Obligations of the contractor," *i.e.*, everything he had to perform for the purpose of carrying out his contract would form another subject. The question of payment and certificates should be dealt with under a separate heading.

It was necessary to bear in mind that whenever the engineer provided that a contractor should perform some particular thing or do some particular act it was no good leaving the Specification there ; it was necessary to provide a remedy in case he did not do it. That naturally brought the engineer to the question of powers, because it must always be assumed in drawing any Conditions of contract that the contractor would try and get out of them, or that he would not perform the Conditions that had been set down. It was necessary, therefore, to provide a remedy for the non-performance of each of the Conditions that the engineer wished to be performed. That could all be brought under another head called " Powers," in which the engineer would be given power to rectify defective work, to take the work out of the contractor's hands, to supply additional work ; power to go on the site ; power to have access for the purpose of inspecting materials ; power to require the sorting of materials, etc. The next heading would probably be the Arbitration Clause, or the final Certificate Clause, *viz.*, what had been called a dispute prevention clause. He desired to explain to the students the difference between those two clauses. It might be provided in a contract that the engineer, in order to prevent disputes

from arising, should be the final certifier in everything. If that was provided the Law Courts could have nothing to do with the contract so far as the Arbitration Act was concerned, because it was a dispute prevention clause and not arbitration, and therefore the Arbitration Act did not apply. That was, to his mind, one of the most binding clauses that could be put into an engineering contract. Then, on the other hand, there might be an arbitration clause, the reference sometimes being to the engineer who carried out the work, and sometimes to an independent arbiter.

Having regard to the last decision in the House of Lords, a provision making the engineer of the contract the arbiter was practically useless, because it was only necessary to allege and prove in some shape or form that the engineer ought to be cross-examined for it to be impossible to say that he was the right person to act as arbiter, because, as one of the Law Lords said, the arbiter was surely not a fit and proper person to examine himself, cross-examine himself, re-examine himself, and then decide on the value of his own evidence. So that the student had to consider, when he prepared his first contract, with the assistance of his lawyer or not, whether he intended to have an arbitration clause or a certificate clause, or whether he was going to refer a dispute to himself or to somebody else. If the engineer decided to make himself his own arbitrator, he must be a man of a most determined character. He must be absolutely fearless; he must not care twopence for anyone, either his employer or anyone else, and he must be in a position to be absolutely free to decide perfectly fairly between man and man. If he was in a position to do that he would not object to any engineer taking upon himself that position. There were many engineers who did so, but it required a man of great strength of character. Given such conditions, no finer contract could be drawn than a contract referring disputes to the engineer who knew all about the work. In the first place it saved both the contractor and the employer an enormous amount of costs if an arbitration did take place, because it must always be remembered that the contractor could produce evidence at less expense than the employer could, and he was generally in the position of being a claimant, whereas the employer was generally in the position of not knowing what to offer, or of not offering enough, and having to pay all the costs of the proceedings. That was one of the most important matters that the students, when they

came to enter into contracts, would have to consider. He would not advise the students to take upon themselves the position of an arbiter unless they felt perfectly clear in their minds that they could tell the man who was employing them that they intended to act fairly to the contractor. That was a very difficult position for any young engineer to hold; indeed, it was a difficult position for an engineer of great experience to hold, because in these days of keen competition he was sure that even the greatest engineers of the day would say they found sometimes pressure being put upon them to cut down the contractor's account. That was a position which no employer should attempt, but still it was done, and a person who was in a position of receiving such suggestions must possess a very strong character indeed so as to be able to tell an employer, as he ought to do, that he could not listen to anything of the kind.

So far as Specifications were concerned, he had already told the students that they required to be extremely careful. The first thing necessary was that they should know what they were writing about, and he advised students to accept nothing as gospel. Owing to the work of the Standard's Committee he supposed that nowadays a good deal could be taken as gospel, and no doubt with very good reason, for that Committee were doing most valuable work, but in all matters which were not covered by the careful work of the Standards Committee, whether it be cement or steel or what not, it behoved the young engineer to take infinite trouble, firstly to know what he was writing about, and, secondly, to put his requirements in the clearest language possible.

Then there were different kinds of contracts. There was a contract for a lump sum; there was a contract at a schedule of prices; and there was also a contract to pay net cost plus profit besides other kinds. All those contracts required very careful drawing. It was law in a sense because lawyers had to settle the exact form that those contracts should take; but assuming that the engineer knew and could express everything perfectly clearly he doubted whether in many cases there would be any necessity for a lawyer to be consulted at all as regards the specification. At any rate a careful engineer is of the greatest assistance to the lawyer. He desired to illustrate that point with a case of a contract which those students present would probably think was the simplest contract to draw, *i.e.*, a contract to pay net cost plus profit. It would not be a bad plan for the students to try and put into writing what they would have to pay a contractor

in such an event, and he would give them a case upon which they might very well experiment. He advised the students to take, for instance, the case of a contract for £500,000 to supply machinery, and to fix it on the work, and in which the employers suggested the very simple arrangement of paying net cost plus profit. First of all, how were the students to ascertain the net cost? The contractor would first purchase the materials; he then would have to convey the materials to the manufactory, where they had to be passed through different workshops. The first stage, the purchase, was quite easy; carriage was quite easy, but how was the charge to be made in the machine shop? Was a charge to be made for the rent of the machine through which the material passed, or were departmental charges to be made for each shop that the material went into? The material having passed through various shops, and, finally, partly or wholly manufactured would be sent on to the works. Establishment charges, charges for material on the site and such things, had to be borne in mind in ascertaining what the prime cost was. A more difficult subject still was that the contractor would necessarily have to employ plant to carry out the fixing of the machinery on the work. Was he to charge for the hire of the plant or was he to purchase it? Was he to charge the value when brought on the works, and credit the amount as it went off the works and charge the difference, or what was he to do? The contractor might very well say, "It would not have paid you to have had to buy all this plant; I thought I would let it to you, tools and everything else." In that way it would be found that the hire of pickaxes, for example, might amount to 30s. apiece by the time the job was done, and everything else in the same proportion. It might be said that his remarks did not really deal with the question of law, but inasmuch as he constantly had to deal with such things, and had to tell people where they were making mistakes and how to draw their contracts so as to keep their client free from liability he hoped he was not addressing those present on matters which they thought were unimportant. The great difficulty was to frame a contract, conditions and specification as a consistent whole, and to make the provisions of real use. In order to do this practical knowledge was required if the application of the various provisions in the carrying out of an engineering undertaking and legal knowledge was necessary, so that these provisions might be so drafted that they could be put in force without fear of legal difficulties. He had applied himself in his remarks rather to the practical side of

the question, and to contracts as a whole because he thought that was the first step, and because the legal questions affecting each of the various conditions of engineering contracts ought to be dealt with separately.

Then the student would no doubt at some time have to submit the drafts they had prepared to their legal adviser, whether they were conditions or anything else. In that case he strongly urged the engineer to let the legal adviser see the Specification, the drawings, and everything upon which he was asked to advise. It was perfectly hopeless to ask anyone to give good advice when he was only supplied with incomplete information. If conditions or contracts had to be prepared for any particular work, the person who was preparing the contract or conditions must be told what the work was that was to be carried out. Each particular piece of work was different; and what the lawyer, and the engineer who was assisting the lawyer, ought to try to do was to foresee all the possible and probable risks and contingencies which might happen during the progress of the work, so that they might be provided against in the conditions of contract and specification which had to be drawn; and unless the person who was settling those things was fully aware of all the difficulties which were likely to take place, it was impossible for him or for his employer to get a satisfactory contract drawn up.

The lecturer had referred to several matters which he should like to endorse and emphasise. For instance, he had spoken of the carrying out of duties under a contract which, it might be assumed, had been most carefully drawn. The students would forgive him for saying that their first duty was to look at and read in the most careful manner all the clauses and conditions of the contract under which they had to work. It was, so to speak, a code of rules not only for the contractor but for the engineer, and no contract, however well settled, was any good unless both parties performed it. The matter which affected the students more particularly as engineers was that they should be very careful to perform all the obligations which were set out in those conditions. If extras had to be ordered in writing, then the order should be given in writing. They should not say to the contractor, "Never mind about that; I will give you an order by and by." Everything should be done methodically and the conditions observed. It might be the case that the engineer had to give written orders when the contractor was to commence the works, and very likely

the penalty clause depended upon such a written order. Perhaps the penalty clause provided that the contractor should complete within so many years or months from the date of the order of the engineer to begin the work. At the end of the work the employer sometimes said, "How about the penalty clause; this work is very much behindhand, and I should like to enforce it." When the correspondence was looked up, however, it was sometimes found that the engineer had not given the contractor the written order to begin so that no date for completion could be ascertained. After having some experience of these omissions, he always tried to put in at the end of the contract what he sometimes termed a "mopping up clause" to pick up all the oversights which might occur during the progress of the work, by providing that if the engineer had failed to do this, or the other, then he could do it at a later date than he ought to have done. But it was very difficult to draw contracts to "mop up" all the forgetfulness that was possible in the carrying out of a contract. Forgetfulness and omissions of the kind referred to were among the chief causes of litigation, and they were the chief difficulties which a lawyer had to deal with when litigation occurred in defending or supporting the case on behalf of the building owner or the employer.

He had spoken for a considerable time, but he had desired as far as possible to be of some practical assistance to the students. If he could render any assistance to them they could count upon him at all times giving them all the assistance in his power. He was steeped in the subject, because he was always dealing with it, and it was therefore no trouble to him, if time permitted, to help the students in any way he could, and he would have the very greatest pleasure in answering any questions that might be asked. He had no doubt that what he had said had raised a great many doubts in the minds of the students which he hoped would set them thinking. He had endeavoured as far as he could to be clear, and to tell them the point from which they ought to start in the drawing up of Specifications, contracts and conditions and as to the performance of their duties under a contract so as to avoid difficulties, and, what was more important than anything else, to keep their employers out of litigation. He hoped that he might some day be invited to address them again, when the legal questions affecting individual clauses of engineering contracts might perhaps be discussed.

Mr. Arthur S. Jecks

Said the author was kind enough to favour him with

an invitation, which he most gladly accepted, to a charming dinner and an entertaining lecture, but he somewhat took the gilt off the entertainment, as far as he was concerned, by asking him afterwards, to use his own expression, "to weigh in with a twenty minutes' talk." He had a feeling that if he attempted to do so at the present stage, it would be a case not of weighing in but of some one or more of the members of the audience showing him the way out. It had been one of the privileges of his professional career to co-operate with the author in preparing and settling contracts which had presented very great detail, and incidentally an expenditure of some millions of money, and the assistance the author had given him in showing how an engineer could help a solicitor when he had not only scientific knowledge, but also the power the author possessed of appreciating the point of view of his collaborator, and thus assisting him in that way had been incalculable. He owed a very great debt of gratitude to the author in that respect.

That dealt with the preparation of contracts, the pacific side of the profession. But, as the Chairman had stated, it was on the other side that engineers could be of as great if not greater assistance to the legal profession. The lecturer had indicated to the students a list of subjects of study which rather appalled him; he went through the whole gamut of legal law, and rather brought forth his (the speaker's) sympathy with engineering students in their studies. But there was one thing the lecturer had not emphasised, which the Chairman had emphasised to a certain extent, namely, the importance to the engineering profession of studying the law of evidence and the science of examination and cross-examination. He thought the experience obtained in the Courts, and possibly still more in Parliamentary Committee Rooms, showed the immense assistance engineers could be to the legal profession when the upper branch of it indulged in the somewhat dangerous experiment of cross-examining witnesses in their own field of study; and he thought if by their training engineers knew, first, what questions could be asked; secondly, what questions should be asked; thirdly, how those questions should be put; and, last, but not least, what questions should not be put, they would be of immense importance to the legal profession.

Mr. Edmund Bristol, K.C., M.P. (Canada)

Said he had listened with a great deal of attention to the very clear and concise statements of legal matters appertaining to engineering which the various

speakers had been good enough to present for the benefit of those present. Mr. Frame Thomson had asked him to say with reference to the laws of the Dominion of Canada whether the laws of evidence and contract, short statements of which had been given, were the same in Canada as in England. He wished to say to the students that substantially the laws, at all events of the Province of Ontario and of the Provinces other than the Province of Quebec, which had the Code Napoleon, were similar to the laws enjoyed in this country; so that if engineers were conversant with Anson's "Law of Contract," or any similar work they could be assured they were fairly well equipped on the law of contracts, so far as most of the Provinces of Canada were concerned. Statute laws varied, of course, in every country, and he thought that, without undue emphasis, the first statement that Mr. Frame Thomson made, that when an engineer had a very important contract he should get close to the solicitor as quickly as possible, was one of the best pieces of advice ever given to a young engineer. He also wished to say, from the solicitor's point of view, that if there was a possibility of a law suit later on the sooner the solicitor got close to the engineer the better for both.

In the few remarks he wished to make he desired to emphasise one particular point. He asked the students to place themselves in the position of engineer-in-charge in regard to a very important contract for the construction of a railroad or any great public work, for which plans and specifications had been drawn up in detail; extras had to be ordered in writing, proper notices had to be given if the work was not going on satisfactorily, and so forth. He advised young engineers to familiarise themselves to start with with the terms of the contract, and then from day to day to obtain evidence of how the contract was going on in such a form that, if at a later stage litigation occurred, the engineer had the particular person he wanted just where he wanted him. From a very large experience he invariably found that the time the contract was usually looked at was when litigation arose, whereas the engineer ought to make himself completely familiar with the contract the moment he started on a very important piece of work. He had been asked to make a few remarks in reference to the commercial side of an engineer's training. It was too late that evening to go into the subject with any degree of particularity, but he wished to say that an ordinary everyday knowledge of company law was a good thing to possess, such as how companies were incorporated, how boards of direc-

tors acted, how companies entered into contracts, a knowledge of the ordinary working of the average company. That was very useful knowledge, because he did not know of any public work of any importance, such as the construction of railways or anything of that character, which was not carried out at the present day by Corporations, and a reasonable knowledge of corporations and their powers was useful knowledge to possess.

Another thing which must be borne in mind was that the engineer's report was usually the foundation of nearly every great work. If an individual came to London with the object of launching some great enterprise, it was necessary for him to have an engineer's report to submit to the capital that he wished to interest in the undertaking. Therefore, what an engineer's report should contain was a very important matter for the students to know, and a very vital matter from the point of view of the success of the undertaking, particularly if it happened to be in South America and the capital which it was desired to interest was in London. If the engineer had not covered all the important points, the capital in London would be very quick to point out the omissions, and when the keenest minds in the world inspected such documents it was of the utmost importance that they should contain all the requisite information. The students would eventually be carrying out work in various parts of the world, and he strongly advised them that, if they could get hold of one of the best reports made to London capital on a very important enterprise in South America, Australia, or wherever it might be, and put it away in their boxes, when they were called upon to make a report they would have a fair working model before them of the important details it was necessary to embody in the report that would have to be written, so that it looked like a report and not like an essay. That was one of the most important branches of the commercial training of an engineer. If on the top of that they knew a little about company law, how franchises were obtained in foreign countries, and how to handle people who obtained franchises, and possessed on the top of that an engineering training they were advancing very far on the road to fortune. He wished the students every success.

Sir Frank Crisp

Said that when Mr. Frame Thomson invited him to attend the meeting he accepted the invitation with alacrity, but with mixed feelings. His first feeling was one of pleasure that he would be able to testify to what a large number of people outside the engineering profession felt as to what

Mr. Frame Thomson had done with a view to teaching the young engineering idea how to shoot. On the other hand he was perplexed as to how law and engineering could be made to assimilate. He remembered the story of the leader-writer who was called upon at short notice to write an article on Chinese Metaphysics. He read the article on China in the *Encyclopædia Britannica* and then the article on Metaphysics in the same book, and combined the two, with not very satisfactory results. It was very pleasing after a lapse of fifty-five years to be in an engineering students' atmosphere, because at one time he was destined for the engineering profession, but unfortunately he was diverted into less lucrative ways. As he understood it, engineers accumulated their remuneration by lump sums of 5 per cent. on hundreds of thousands of pounds, whereas solicitors had laboriously to pile up six-and-eightpences, three hundred of which amounted to only £100.

Having been favoured with an advance copy of Mr. Frame Thomson's lecture, he found on studying it that there was a great deal more in the connection between law and engineering than he had ever dreamed of. He began to see that not merely was it desirable for an engineering student to study law, but that it was absolutely indispensable to his education, and that without it he would not be a complete or perfect engineer. It was quite a mistake to suppose that lawyers objected to people studying law or knowing law. The true millenium for the legal profession was not the millenium of the Ecclesiastic; but the millenium when every man would try to be his own lawyer. The legal profession would then have to be increased ten-fold in order to straighten things out a bit. The great practical question, at any rate for those who had to set the curriculum for engineering students, however, was what amount of law they should study—to what extent in breadth, and how far in depth. With regard to the extent, he was inclined to think that if they studied the law of contracts and the law of evidence it embraced nine-tenths of the law it was necessary for them to study. He excluded from "law" the Building and Highways Acts and such things which were administrative and hardly "law," although they were enacted by Act of Parliament. In other professions it was very necessary to study many other branches of the law; for instance, an accountant must study the law of partnership, whereas an engineer hardly ever required to know anything about the law of partnership, except on the one day on which he entered into a partnership with somebody else, and

for that he could easily go to a lawyer. He differed a little from the advice given by Mr. Bristol, as personally he thought a knowledge of the law of Companies, in England at any rate, was not of much value to the engineer. He gathered that in Canada and America questions of franchise were a little intricate, but in England he should not have thought the study of Company law was necessary for the engineering student. He would be quite satisfied if the engineering student studied contracts and evidence. The question of depth was far more difficult, because all the pitfalls of the law lay at depths. He could amuse himself till midnight by going over the pitfalls and anomalies which the law presented, but he must confine himself to one or two of the more striking instances.

(1) A young engineer learned that there was an Act of Parliament which said that unless a man making a contract signed it it was not valid. The young engineer, acting for his employer, received an order on a billhead from "John Smith and Co." for so many tons of pig iron. Being under the impression that the order was not executed in proper form, as it was not signed, he returned it to John Smith and Co., with the request that they would sign it, and in doing so he was under the impression that he had done a very clever thing for his employer. In the meantime, the price of pig iron went down, and John Smith and Co., receiving back their order on the billhead, wrote to say that circumstances had arisen which made it no longer necessary for them to have the pig iron. The lawyer of the employer on being told the facts said, "You have returned the man his contract—he is no longer bound." The young engineer replied, "But it was not signed; the contract was no good;" and he then discovered for the first time, what hardly anybody but a lawyer knew, that the law said it was a signature if a man wrote on a billhead without putting his signature to it. That was a pitfall of which a young engineer would not dream unless he had studied the law to some considerable depth.

(2) There was another peculiarity of law which he would put before the students in a simple form, although he hoped the instance he quoted would never happen to any of them. Supposing one of the students owed a man £100, which was a load round his neck, and he went to his creditor and said, "Will you take £50 and be done with it?" He would presume that the creditor complied with the request, although it was very rarely that such a thing happened, and gave the student a receipt in full discharge for

£50. Four years afterwards the creditor died, and the executors then wrote to the student and said, "You owe £50 to the estate." The student replied, "No, I have a receipt in full discharge." But the receipt was of no use as there was no consideration. If, however, the young engineer had paid £50 and a pair of five shilling gloves, and the creditor had accepted that the law would have recognised that that was a complete discharge of the debt. The law insisted that £50 and £100, the units being the same, were not equal, but the law would not pretend to value a pair of gloves, and the £50 and a pair of five shilling gloves was therefore a complete discharge for £100. There was another way in which such a transaction could be made valid. All those present had seen boxes of little red wafers in stationers' shops which could be purchased at the rate of ten a penny. If one of these was put against the signature that made it perfectly valid, and the law no longer objected that in paying £50 for £100 the debtor had not completely fulfilled his bargain. The law regards the wafer as a "seal," a very sacred thing.

(3) Penalties were a source of great trouble to the law. On the criminal side, at the Old Bailey, the law revelled in penalties, but if the civil law could construe a thing into a penalty so as to get rid of it it would. For instance, supposing a man wanted to borrow money on mortgage, and the mortgagor said to him, "I will charge you 5 per cent., but if you do not pay punctually I shall charge you 6 per cent.," that would be absolutely invalid. Their forefathers got over the difficulty in a very neat manner by providing that the interest should be 6 per cent. reduced to 5 per cent. if it was paid punctually, and the law cheerfully accepted that proposition.

(4) A point that the lecturer had referred to was always a puzzle to shareholders in companies. Supposing a man applied for shares in a particular company, and was then told by a friend that it was a swindle and he must withdraw his application; he wrote a letter of withdrawal and posted it. In the meantime the company had posted the letter of allotment. When the shareholder received it, however, he at once returned it with the remark that it was too late as he posted his letter of withdrawal on the previous evening. He then found to his disgust that what was law for the goose was not law for the gander; that the posting of the letter in his case did not fix the matter, while the posting of the allotment letter did, and that he was bound to take up the

shares, notwithstanding he posted his letter of withdrawal hours before the company posted their letter of allotment.

(5) Another great pitfall occurred in regard to the question of varying contracts verbally. As the lecturer had stated, the principle of law was that it was impossible to vary a written contract by word of mouth or a deed by a simple writing. But the exceptions to the rule were so numerous that practically the rule was almost abolished. It was ludicrous to see the number of ways in which a contract, even if by deed, could really be varied without anything in writing, the law refusing to admit it had been "varied" while at the same time admitting that exactly the same result had been arrived at. In all such things it might be said that "the law was a hass," but there was a certain amount of principle in those anomalies, and it was no use arguing about them, any more than in the case of the friend who argued with the poor man in the stocks that he *could not* be put in the stocks for the offence he had committed, although he was in fact in the stocks all the time. There he was, and it was no use arguing about it.

In considering the question of depth there was one solace. The students had heard the adage, "Drink deep, or taste not the Pierian spring." But however deep one might drink of law it was not necessary to retain all of it. It was a curious fact that a man might be an excellent lawyer and be able to advise a large *clientèle* of business men, and yet know very little of law beyond the principles which he learned twenty-five years previously. The explanation of the paradox was that he knew, having drunk deep, *where to find his law*. When a client came to a lawyer with a knotty point he shook his head and told the client to come the next day. He knew exactly where to put his hand on the law, and when the client came next morning he was able to expound it in the completest manner.

Mr. Frame Thomson

Desired to be allowed to say a few words of thanks to those present for the very kind manner in which the vote of thanks was passed at an earlier stage of the proceedings. He had learned a new secret of success at the meeting. Everyone had heard of the saying of throwing a sprat to catch a whale, but he thought the little sprat he had thrown that evening had caught three or four very fine whales. The lecture had been delivered under great disadvantages on the present occasion. There were a large number of gentlemen present representing important financial and other interests, and if the

meeting had been held in the theatre of their own Institution he would have had the pleasure of having them on the platform with him. He hoped that on a future occasion when another of the lectures was delivered the proceedings would be held in their own theatre, so that the students might have an opportunity of seeing those gentlemen instead of gazing on the backs of their heads. He thanked all present most heartily for attending and supporting him in his effort, and he trusted that one of the results of the discussion would be to satisfy them that the study of law was not such an extremely dry matter as it was often supposed to be.

On the motion of Mr. H. V. Hutt, Secretary of the London Students' Committee, a hearty vote of thanks was accorded to Mr. Hall Blyth for presiding over the meeting, and for the able remarks he had made.

The Chairman

In acknowledging the vote of thanks, said it was a very great pleasure to him to take the chair at any students' meeting, and it was a double pleasure to him to take the chair in view of the interesting lecture which had been delivered. He agreed with Mr. Hudson's remark that if a man thought himself able enough and clear-headed enough to be his own arbiter it was impossible to make a finer contract than that, but in his opinion very few such men existed; and if the students took his advice they would never make themselves the arbiters under any of their own contracts. He also wished to advise the students not to be led astray by the gilded statements which Sir Frank Crisp had made. The days of 5 per cent. on hundreds of thousands of pounds had long since disappeared; it was the solicitor who was coining the money, and not the poor, unfortunate engineer.

APPENDIX.

ABSTRACT OF PROCEEDINGS AT THE FIRST FRAME THOMSON LECTURE, 1911.

Sir James Inglis, who presided, announced that the lecture was the first of a series upon the necessity of keeping commercial principles in view when designs of engineering works are being made. He pointed out that the Institution had taken a leading part in promoting the theoretical and liberal training of young engineers, and that other practical training is now receiving attention. He summed up the commercial duties of the engineer in the words, "a reasonable return on money, safety in working and use, and permanence and stability."

Mr. Balfour Browne, K.C., leader of the Parliamentary Bar, expressed warm approval of the suggestion that engineers should have knowledge of commercial matters. He said: "You must, to a certain extent, be a bit of an accountant, and you must know something about law, the laws of evidence, of contracts, and other things of that sort. You cannot be specialists except in engineering, but at the same time a general knowledge will be of admirable service to you in your profession."

Mr. George A. Touche, M.P., Chartered Accountant, cordially approved the high standard set before engineers. He condemned the too prevalent feeling that the business side of engineering enterprises is unworthy of the engineer's attention. He summed up the commercial side of the engineer's work in the correct anticipation of the cost of construction and estimates of revenue in relation to working expenses. He said: "From the point of view of the City and finance we do not want everything to be dominated by the consideration of cheapness at any cost. The essential point to the commercial and financial mind is that the estimate of the engineer should not be misleading. Temper your optimism and enthusiasm by the analysis of detail and by attention to the thousand and one difficulties which lie in the way. Study to be reliable."

The lecturer introduced his subject by a reference to the change that has taken place in the attitude of the professional classes towards commercial questions, the old prejudice against these as

being sordid and inimical to high ideals now rapidly disappearing. He traced the transition in the means of obtaining resources for the construction of engineering works from the earliest days when these were entirely supplied by autocratic governments, down to the present time when private capital is the chief source of supply, and demands a profitable return as a *sine qua non* of providing the funds. This condition has brought with it the need that engineers should have some familiarity with the habits of thought and methods of business of those who control capital; with the principles of accounting which determine questions of profit or loss; and with the legal principles that govern commercial affairs. He laid great stress upon the value of well-regulated imaginative power as tending to maintain high ideals, and as a great help in suggesting solutions of engineering and business problems. He mentioned that his own knowledge of commercial law had been obtained at evening lectures, and his knowledge of accounting principles largely by keeping his personal accounts on the recognised double-entry lines. He recommended these methods to the students of the Institution.

The following extracts give the main points of the lecture.

“ The object of these lectures would be hopelessly perverted if they tended to lower the ideals of which every engineer is proud. On the contrary, it is my earnest hope that one of the results will be to impress upon you that permanent commercial and financial success not only may, but must, be based on the same principles of reliability, efficiency and security that you apply in your technical work. To have a sufficient and intelligent understanding of the principles and practice underlying the operations of merchants and financiers, so that where our work is precedent, parallel or supplementary to theirs, we may adjust it to produce the greatest combined efficiency, is no discredit to an engineer. The very nature of an engineer's training and instincts provides him with many habits of thought and action which make him a valuable collaborator, provided he is possessed of the working knowledge to appreciate their application to other activities than his own purely technical branch.”

“ The profit of a harvest is the excess by which the value of the crop exceeds the cost of the seed and the expense of the operations. To secure a profit the organism must be capable of growth.”

“ Stagnation is a condition inconsistent with the life of a healthy organism. Growth and decay are the active manifestations of life. By the prevention of decay and the stimulation of growth maximum efficiency is obtained. Any enterprise that is

radically sound cannot help growing (that is, making profits) if every element of waste and loss can be eliminated."

"These considerations may appear at first sight to be more properly within the functions of the operating engineer, but the designer and constructor, to be of the greatest value, must think backwards from the field of action of the operating engineer to the starting point of their own problems."

"Your contact with the human element does not end with the labourers, foremen, superintendents and managers. Behind all these are the brains whose financial ability secures the means by which your works come into existence. The functions of their formulæ are capital and profit; their great common denominator is money. What we have all to realise is that, just as much as steel and concrete, money is one of the things we have to deal with in engineering structures."

"And it is precisely in such relationships that the engineer finds the greatest value in general commercial knowledge. I am not for a moment advocating that you should be jacks of all trades and masters of none. But I do advocate that you should be *pastmasters in the art of taking pains*, and whilst your greatest pains should be devoted to the mastery of your own profession, a suitable proportion of your time and ability and labour should be devoted to making yourselves familiar with the methods of work and ways of thought of other professions and businesses."

"Don't get the idea into your heads that any smattering of law which time will permit of your obtaining will justify you in acting for yourself in matters which are the province of the lawyer. A little knowledge is a dangerous thing if it inspires presumptuous self-confidence. One of the great benefits of a little knowledge of law is that it opens out to your view many pitfalls of which you would otherwise be unconscious, and provides a danger signal warning you to secure sound legal advice when you might otherwise blunder into serious errors."

"Your position will be immensely strengthened if you can intelligently understand accounts, analyse them, and recast them into statements which go further than the accounts in showing the grouping of expenditure or receipts so as to throw important sidelights on special aspects of cost or revenue. Especially important is this faculty in relation to the operating accounts of commercial and industrial enterprises. In these matters there is no more effective solvent than the ability to represent the course of expenditure and receipts graphically, and your familiarity with this method provides you with a valuable means of tracing out problems, based upon accounts."

“ No amount of care or study will absolutely guarantee success for any enterprise, but care and study intelligently applied will at any rate reduce the adverse contingencies to the limits of ordinary business risks. They may even make all the difference between success and failure, as has been proved over and over again in cases where water-logged concerns have been pulled round and set on their feet by men capable of seeing the defects and applying the remedies. To correct such a situation, or to foresee and prevent it, obviously requires some knowledge of all the elements, and not merely complete knowledge of one of them.

“ I should like to urge upon you the belief that there is no kind of knowledge that does not find its niche of utility at some time or other in your careers. In a very special degree this applies to making copious notes of all information, wherever you find it, of the cost of work and materials. It is not sufficient merely to note these data and index them, you must expand them and reduce them to units of general application. There is a subtle but very real analogy between the cost of work of different kinds and executed under different conditions, the appreciation of which is perhaps more of a natural talent than an acquired accomplishment, but is capable of great development by continuous assimilation of all available material respecting costs of all kinds.”

ABSTRACT OF PROCEEDINGS AT THE SECOND FRAME THOMSON LECTURE, 1912.

Mr. John Strain, Vice-President, Inst. C.E., presided.

Sir William Plender, President of the Institute of Chartered Accountants, in the course of his remarks said:—

“ Until the principle was recognised that the two sciences of engineering and accounting were closely connected there would be waste and ineffectiveness. Whilst it would be foolish for engineers to assume the functions of accountants or for accountants to usurp those of the engineer, yet a great step forward would be gained if engineers realised the value of true accounting principles and saw to their introduction. Proprietors of works sometimes looked upon money spent on bookkeeping as being unproductive, whereas the waste which resulted from its

absence probably far exceeded its cost. It was highly important that a sound basis of arriving at depreciation should be instituted in large works, as true profit divisible amongst shareholders could not be known until the wear and tear, which took place in machinery used for production, was arrived at."

"In arriving at net profits it was essential to consider the life of plant and machinery in use, and provide for its proper maintenance, and for its extinction over the right term of years."

Mr. L. W. Hawkins, Member of the Institute of Chartered Accountants, emphasised the necessity for having liquid assets available for renewals and for writing off assets which have no value realisable in cash.

"The writing off of capital expenditure, which was not represented by tangible assets, was no mere academic fancy, but was a means of strengthening the financial position, and, if carried on in conjunction with a system of liberal depreciation and renewals, and perhaps even a provision for new capital expenditure out of revenue, the result, while conducive to a paucity of dividends in the early part of the Company's history, could not fail to be of immense subsequent benefit to it. It was often the case that an ounce of strength from within was worth a pound of help from without. Or, to put it another way, profits used by a Company in its business might be regarded as muscle, while borrowed money might be no better than a crutch. It was by means of a conservative policy, such as he had indicated, that Companies were enabled to attain a position of unassailable strength."

The following extracts give the main points of the lecture.

It is unnecessary in this lecture to enter upon the detail forms used in book-keeping, as these can be studied in any text book on the subject.

More important are the principles of the Science of Accounting. The evidences of life are growth and decay, and in business these expressions are represented by profit and loss. The function of accountancy is to show at any time which of these is in the ascendant and why, so that the forces tending to growth or profit may be encouraged, and those tending to decay or loss reduced and eliminated.

The idea of growth involves the existence of something capable of growing, and in business matters this something is Capital. Capital expenditure is in the first instance expenditure of all kinds necessary to bring the enterprise up to the point of productiveness. The money provided to meet this expenditure is the

Capital of the concern, although as a general rule the word Capital is applied to the shares or other securities created for the purpose of being sold to produce that money.

When the enterprise begins operating a new phase is entered upon with the rendering of services in exchange for payment. Out of this Gross Revenue the cost of labour, materials, salaries, and other current expenses internal to the business are paid, leaving, if successful, an excess of receipts over expenses, known as Gross or Trading Profit. From this are deducted non-current expenses such as depreciation, renewals, and expenses external to the business, such as taxes and interest on borrowed money, leaving the Net Profit. From the Net Profit appropriations are made to Reserve Funds of various kinds, including the redemption of any Capital invested in property of a wasting nature, dividends are paid to partners or shareholders, and the remainder is known as the Carry Forward or Surplus.

The science of accountancy is directed to the study of the nature in detail of each of the following processes, and of the principles upon which the dividing lines should be ascertained and the book-keeping records kept so as to present a true statement of the facts of each process, and the results of their operation.

1. Constructive or creative processes.
2. Productive or operative processes.
3. Destructive processes.
4. Reconstructive or reproductive processes.

The Constructive or Creative processes are comprised under the headings Capital and Capital Expenditure.

The Capital usually consists of cash or its equivalent in property by which the business is established. In joint stock companies the Capital consists of shares or securities intended to be sold to produce cash, or to be issued in lieu of cash in exchange for property, services, or rights. The Company has to account for all the Capital by showing expenditure equal to it in amount. The Capital Expenditure is the positive or credit side of the Constructive process and represents the cash, property, services, or rights which "stand to the credit" of the Company, whilst the Capital is the negative or debit side, which the Company owes to the holders of its shares or securities.

The Productive or Operative Processes find their expression in Revenue Account and Expenditure on Revenue Account. Expenditure is incurred in the manufacture of products or the rendering of services, and is paid for out of the receipts from the sale of the products or services.

The most debatable section of the subject is the treatment of the Destructive Processes.

In selling the shares or securities, the services of brokers, financial houses, printers, probably advertising agents and others, have to be paid for, and the purchasers of the shares and securities may not pay for them the full face value but only buy them at a discount, so that here we have shrinkages against which we must sooner or later set a Reproductive Process.

The acquisition of property and rights frequently involves heavy expenditure upon rights of a terminable character. The diminution in the value of these by lapse of time has to be reckoned with as a destructive force.

In operating, the destructive effects of wear and tear become apparent. Parts get out of adjustment and are restored without change of the structure. Such cases fall under maintenance, and are included in the current operating expenses.

An intermediate class includes cases where a small accessory part of the main structure has to be replaced, as, for example, a fishbolt with a worn thread or a broken fishplate.

The extreme class includes cases where the wear and tear may continue over a prolonged space of time before requiring to be dealt with, and then involving expenditure upon a scale such as would upset all periodical comparisons, if suitable provision for it were not made by anticipation. This class is dealt with under the heading of Renewal Fund amongst the Reconstructive Processes.

The Destructive Process known as Obsolescence is similar in kind to Depreciation (referred to later), and covers those shrinkages in value of such property as machinery, patent rights, etc., arising from the invention or discovery of improved machines or methods, with which the established machinery or methods are incapable of maintaining effective competition.

An important Destructive Process is that of Depreciation. This applies to such kinds of shrinkage in value as arise from general falling off in efficiency of the whole combination of property rights and equipment.

It will be obvious that all the Destructive Processes outlined above have the effect of reducing the value of the property, rights, or cash representing the Capital, and cannot be counteracted by the creation and issue of more capital. Consequently if the balance of forces is to be preserved, the Reproductive Processes must be derived from the profits arising out of the Productive Processes.

The Reproductive Process of Maintenance is thus absorbed into the expenditure side of the Productive Process.

All the Destructive Processes, with the exception of those provided for by Maintenance, are either liable to occur at irregular intervals or to operate gradually over long and perhaps indefinite periods of time, so the corresponding Reproductive Processes are dealt with by means of accounts separated from the Productive Process.

The provision to be made for Renewals is made by deducting from Net Revenue such a sum as will at a safe rate of interest, provide the amounts estimated to be required from year to year over a considerable period. These debits to Revenue are credited to Renewals Reserve Account, and when the amounts are definitely set aside in cash or investments, earmarked for this purpose, they become Renewals Reserve Fund.

Next in order to Renewals Fund comes the Reproductive Process required to cover shrinkages definite in amount and in the length of time during which they occur. The process adopted is to deduct from Net Revenue a suitable amount annually or otherwise, and credit the same to a Redemption Account. But this process differs from Renewals in the respect that it is not essential to have the amounts set aside for it earmarked in cash or quick assets. If the other property of the concern is increased the Capital issued for the wasting rights becomes represented by assets of another kind.

We are now left with the consideration of two vague but none the less real causes of wastage, Obsolescence and Depreciation. The provisions to be made for counteracting them must be largely guided by personal judgment. The only practical help that is obtainable is from a series of re-valuations from time to time of the entire property and assets of the concern.

Obsolescence may be counteracted by special additions to the Renewals Fund, or preferably by the creation of a Special Renewals Fund, so that the means of purchasing the new equipment may be ready to hand when required.

Depreciation Reserve Account is usually created by debiting Revenue with amounts calculated upon assumptions as to the life of the whole or such parts of the property as may be liable to deterioration over a long period of time, and are not sufficiently definite in character to be properly included in Renewals. The main object of the Depreciation Account is not the replacement of property or assets, but the maintaining of their value as a whole upon an equality with the amount of capital outstanding from time to time.



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